COMPUTERWORLD

THE NEWSWEEKLY FOR THE COMPUTER COMMUNITY

Weekly Newspaper – Second-class postage paid at Boston, Mass.

Vol. III No. 5 | February 5, 1969 | Price: $9/year

PL/I Standardization Postponed

PHOENIX – PL/I, which four months ago appeared to be heading for almost immediate promotion to "standard language" status like Cobol and Fortran, suffered another major defeat last week when the U.S.A. Standards Institute X.3 Committee decided it was not yet ready for standardization. The decision will probably prevent PL/I from becoming a standard language before 1972.

The committee also decided that PL/I needed to be further developed internationally and intends to ask the International Federation for Information Processing (IFIp) and the European Computer Manufacturers Association (ECMA) to assist in the work. What this development would consist of was not immediately clear.

Procedural Problems

The decisions were made at a regular meeting of X.3 after some procedural problems. At the previous X.3 meeting in December, the position had been that the technical committee, X.3.4 had recommended that X.3 approve PL/I for standardization. This recommendation was opposed by a few X.3 members who succeeded in having the motion tabled.

Early in January, X.3.4 became aware that its report to X.3 in favor of PL/I was procedurally improper because it contained some material which represented only the opinions of its chairman, Tom Steel, Jr. of System Development Corp., who is said to be very much in favor of PL/I.

X.3.4 formally told X.3 that these opinions were not part of the X.3.4 position, and then went on to discuss the technical situation of PL/I. During the discussions, it became increasingly clear that X.3.4 was still unable to firmly define the PL/I language adequately enough to consider it for standardization.

As a result, it passed a motion reversing its original stand in favor of PL/I – and told X.3 that it was "premature at this time."

However, when the senior committee opened its meeting, it was found that it had a number of procedural problems of its own involving motions which had been improperly handled. This problem was cleared up by effectively clearing the decks and starting all over again.

Ad Hoc Committee Dissolved

When it did restart – and with members of the technical committee in attendance giving advice – the result was to effectively quash PL/I standardization for some time.

Normally, an ad hoc committee would not consider what to do. However, the PL/I ad hoc committee dissolved last summer after its recommendation on PL/I had been accepted by X.3.4.

Honeywell Enters Service Bureau Field; First of 17 Centers Already Operational

By a CW Staff Writer

MINNEAPOLIS, Minn. Honeywell is entering the service bureau business by opening seven time-sharing centers and 10 batch-processing centers.

The regional time-sharing centers will use the recently announced Honeywell Series 16 time-sharing system.

The 10 batch-processing centers will be located at Honeywell's customer education centers. The first bureau already has been opened here

The company said that there would be no reduction in the amount of support that the education centers give Series 200 users.

New Division

The whole operation is being run by a new division, the Information Services Division. Claude Smith, division general manager, said that the centers will sell data processing services "as a retail item." He broke down the services to be offered into five major groups – data preparation, systems analysis, programming, processing of data and preparation of finished reports – as well as the selling of time.

At a news conference at company headquarters, a three-man executive team headed by J.H. Binger, board chairman, described the step as a vital part of Honeywell's continuing effort to meet the rapidly diversifying information handling needs of data equipment users by offering

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Claude Smith

Problems Plague HEW Payroll System; Error Rates Have Run as High as 23%

CW Washington Bureau

WASHINGTON, D.C. – Inadequate computer input and poor document control were cited by government investigators as the primary cause of troubles which have plagued the computerized payroll system of the Department of Health, Education and Welfare since its installation in 1965.

The HEW EDP system, built around three RCA 3301s, takes care of more than 110,000 employes with annual gross earnings of more than $850 million.

The continuing malfunction of the system was revealed in a report issued late last week by the General Accounting Office, Congress' fiscal "watchdog" agency. The report, entitled "Need for Improvements in the Automated Central Payroll System of the Department of Health, Education and Welfare," included a review of HEW's computerized payroll procedures for the years 1965-68 and recommendations for an overhaul of the system.

Placing the Blame

Predictably, the general press was filled with horror stories, such as the Washington Evening Star's "HEW Computer Runs Amok With Payroll, Hands Out Thousands." However, GAO placed the blame on inadequate computer input, inaccurate record keeping, and lack of effective document control. Although the necessity for stringent management control techniques are well known, the agency stated, "Many of the controls that are necessary for an effective computer system were not being employed by the HEW central payroll system."

Among shortcomings in document control cited by GAO were: (1) failure to promptly introduce data on termination actions into the computer system, resulting in payments to employees after they had resigned; (2) use of the same document more than once, causing duplicate payments for unused annual leave; (3) inability to locate documents, resulting in significant delays in making payments to former employees for their unused leave; (4) failure to enter data into the computer on certain types of earnings paid through a special manually prepared payroll, resulting in the exclusion of the data from the recipients' earning records.

GAO also pointed out that as far back as 1966 one of its study groups had evaluated the central payroll system and found it sub-

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TWX Sale Affects Dataphone Users

By Peter L. Briggs
CW Staff Writer

NEW YORK – Complications have appeared for users of Dataphone equipment, including the KSR and ASR model 33 and 35 Teletypes, as a result of the sale agreement between AT&T and Western Union.

Under the agreement, AT&T agrees not to offer, for a period of five years, teletypewriters with speeds below 300 bits per second to its Dataphone customers. (Current units operate at about 100 bits per second for the ASR-33.)

This means, according to a spokesman for AT&T, that, when the sale of TWX is finalized, there will be no opportunity for users of this type of Dataphone equipment to upgrade their existing equipment or order new equipment through AT&T.

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$1 Million Embezzlement Arranged by Accountant

SALINAS, Calif. – A service bureau owner here used his computer to budget embezzlement so smoothly that he was able to take a quarter of a million dollars within a year from a fruit and vegetable shipping firm without the loss being noticed. He was caught only when a small-town bank became suspicious of the size of a check made out to a labor organization.

The bureau owner, Robert Mansfield, 38, last month was sentenced to from one to 10 years for grand theft and forgery. Officials said more than a million dollars was involved since the embezzlements started in 1963. His service bureau closed down on his conviction.

Mansfield joined the firm, Carl Joseph Maggio Inc., in 1957 and became its accountant. After five years he discovered that the firm had no complete audit operation and saw an opportunity, court officials said. His method was to make the company believe that the produce was costing more than it actually was, so that operational costs, profits, etc. all strayed in balance. He kept the balance carefully regulated by having the firm's accounting work handled at the computer service bureau which he had set up and by budgeting just how much he should embezzle during a specific period. He did this by using both the false and the real data in different computer runs and by comparing the results, they said.

Suit Threatens Industry Stability, Frank Says

NEW YORK – The Justice Department should proceed with deliberate caution in its antitrust action against IBM to avoid disrupting the stability of the "relatively young and still highly volatile data processing industry," according to Gordon Frank, president of Software Sciences Corp.

Frank described the entire computer industry "as still immersed in a definitive process which may not be completed for another 10 years. This has been caused by three generations of advanced computer technology since the early 1950s, and user requirements which have burgeoned to more than 60,000 installations across the country today."

Related Stories on Pages 10 and 11

Noting IBM's major position in the data processing industry, Frank said the company shares with corporate leaders in other fields the singularly uncomfortable position of being extremely vulnerable to critical comment from competitors and customers alike.

IBM Set Pattern

While the merits of the antitrust suit will be decided in the courts, IBM's success has in effect set a pattern for much of the explosive growth experienced by the entire data processing industry today, he said.

"First, IBM has contributed to a framework for industrywide expansion by helping to define and develop numerous new areas of computer application in business, science, government, and education. And while the structure of the data processing industry has not yet been solidified, avenues for growth have been provided which otherwise might not have been so readily achieved.

"Second, a continuing flow of IBM technical data has helped thousands of companies now providing computer equipment and services to serve computer users more effectively and keep fully informed on important new developments in the field.

IBM Supplies Manpower

"Third, IBM has served as a vast pool of highly skilled and trained manpower through thousands of former employees now holding responsible positions with both computer users and other companies selling to the data processing marketplace.

"Fourth, IBM's own support requirements – particularly in the massive job of developing and producing the IBM 360 – have contributed to the growth of many smaller firms which today are supplying the company with a broad range of data processing products and services."

Pressure Mounting on IBM

Frank added that while there is growing pressure to modify IBM's pricing and servicing policies, restrictive measures should not be implemented without considering their impact on the estimated 40,000 IBM computers already installed in the United States.

Understanding Required

"The complex nature of computer technology – already reaching out for fourth generation systems – requires an in-depth understanding of user needs and the best means for serving them. This calls for intelligent and farsighted decisions which will not only meet current and future requirements for technological support, but also will enable the industry to continue its growth with a firm and well defined sense of direction," Frank said.

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The generation gap

Soon after the first announcements of integrated circuit computers, it was apparent that the new generation had a major split down the middle. The third generation had brought a fourth right along with it. Both represented far more power than earlier machines of equivalent size; both scored major new achievements in cost, performance and reliability. But the similarities stopped right there. The third generation switched from transistors to integrated circuits. The fourth generation did that and more. It switched to a whole new concept in computer design: a computer controlled by its own inner computer. The operating characteristics of the overall system are controlled by micro-programming the inner computer. Accordingly, the user can adapt the logic design of the computer to optimize the system for different types of problems. The tremendous flexibility of fourth generation computers derives from their machine language independence and their high degree of problem adaptability. In practical terms, the computer-within-a-computer delivers significant performance advantages at a much, much lower cost.

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Editorial

What's In A Name?

In the news last week was an item about the rate at which personnel details are being placed in "The National Registry." Once there, they are stored in the computer's memory bank and are used to match people to jobs that are open or will open in the future.

John E. Sullivan, president of the Registry, said he believes that 30% of all employment placements will result from computerized job-matching within five years, so that The National Registry and its style of operation will be a significant factor in the national life.

The National Registry is not, as one might suppose from its name, a government operation. It is a commercial firm, associated with Computer Applications, Inc. *Computerworld* feels that the choice of name for the company is unfortunate. There is sufficient evidence to suggest that people already believe that computers can contribute to an Orwellian 1984 style of government. We believe that the use of "The National Registry" as the name of this activity will just mislead and frighten people – which is not good.

Industry Foreign Policy

The price of superiority in any technical area is that people far away will look to you to see how things should be done. As a result, your reputation is decided not only in the immediate area of your operation but also in far and distant places – so far away, in fact, that you may not be aware of what is happening.

American superiority in the computer area is well-known and one of the country's most valuable assets. However, this means that as our products and services are used in other parts of the world because of their superiority, the name of not merely the manufacturer but also this country is involved.

Currently, there is a controversy in Great Britain about the problems of disk packs and the maintenance of disk drives. It has been resolved at the moment by an almost dictatorial maintenance price increase on disk drives using unapproved disk packs. This increase has not been made by an American firm but by a British firm, International Computers, Ltd. However, the key fact behind the increase is that the use of such packs voids the warranty offered by the disk drive manufacturer, Control Data Corp., to ICL. This means that the underlying cause of the maintenance price increase is in America rather than in England.

Computerworld questions the validity of the approach. Control Data admits that it has not tested all of the disk packs that have come on the market and at least one American manufacturer, Memorex, guarantees to compensate the customer for any liability to the disk drive owner that occurs as a result of the use of its packs. This matches very well with the IBM philosophy of generally accepting the use of outside disk packs and merely holds the user liable for actual, proved damage to the drive.

That seems the proper way to keep the American name strong in distant areas.

COMPUTERWORLD
THE NEWSWEEKLY FOR THE COMPUTER COMMUNITY
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Weekly Newspaper – Second Class Postage Paid at Boston, Mass. Published every Wednesday by COMPUTERWORLD, Inc., 60 Austin St., Newton, Mass. 02160. Telephone: (617) 333-5600 & TWX: 710-335-6635. Copyright 1969 by COMPUTERWORLD, Inc.

Alan Taylor, *Editor*, Robert M. Patterson, *News Editor*, Evelyn Cornell, *Special Supplements Editor*, Neal Wilder, *National Sales Manager*, Margaret Phelan, *Circulation Manager*, Nancy Fling, *Art Services Supervisor*, Kate Rachmiele, *Typesetting Services Supervisor*, Patrick J. McGovern, *Publisher*, W. Walter Boyd, *Associate Publisher*.

Subscription rates are: $9 for one year, $16 for two years. Add $1 per year for Canada; $3.50 per year for Foreign. Please send all editorial and subscription material to: COMPUTERWORLD, 60 Austin St., Newton, Mass. 02160. (617) 333-5600.

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Viewpoint

Optical Character Readers to Play More Important Role in 1970s

By Herman L. Philipson, Jr.
Recognition Equipment Inc.

Optical character reading systems today are used primarily in financial applications. For example, the majority of my company's systems are used in such applications as revenue accounting for airlines, allotment processing for the government, in European banks, and in the credit card industry where we process about 100 million documents every week.

It is easy to overlook the fact that these applications constitute by far the largest use of OCR equipment in the world today – and they all involve reading several styles of printing from documents prepared in several hundred thousand locations in a largely uncontrolled environment. A lesser number are used in operations applications such as motor vehicle registration, education, newspaper publishing, market analysis, and catalog card processing for libraries.

However, I believe that by 1975, optical readers will be used extensively in many areas of information processing for business operations and, to some extent, in the areas of planning and control and in scientific and engineering applications.

Today, OCR systems read only a very small fraction of the data input for batch processing. By 1975, they will handle a substantial portion of all information for batch processing and will be coming into increasingly widespread use as a real-time, on-line input method.

Future Needs

What will be the functional requirements imposed on OCR systems of the seventies in terms of:

What they read?
How well they read?
How they read?
How they handle paper?

First, what they read. Today, a considerable portion of the information read by optical readers is numeric and much of it is stylized. Despite the fact that multifont capability has existed for several years, there has been only a very small number of truly multifont applications. By this, I mean applications where a variety of conventional type styles must be read on an intermixed basis. One example is the U.S. Army Finance Center, where our Electronic Retina Computing Reader reads allotment payments printed on ordinary office typewriters at Army bases throughout the world. We also have seen the introduction of readers capable of reading handprinting although they have not yet come into wide use.

Alphabetic Reading Coming

By 1975, most OCR applications will involve reading some alphabetic information. There will be a major trend away from the current practice of using retyping and OCR as a conversion method. The move will be to direct reading, which provides the ultimate payout from OCR. The truly multifont application will be commonplace.

There will be standardization in specialized applications using fonts such as OCR-A – or the much less stylized OCR-B font that has been widely adopted in Europe, but the majority of business information will be prepared in the conventional type faces that have evolved from pictographs over many thousands of years. And, there will be an increased requirement for reading handprinting.

Reject Cost to Rise

Second, how well they read. This is now and will continue to be the most important question to be answered in evaluating reading machines. Improvements will be made in readers and in input preparation devices, but many input documents will still be prepared by humans in uncontrolled environments, and the cost of correcting mistakes that get into a computer and of manually handling rejected documents will rise continuously.

Programmable?

Third, how they read. I don't mean the technology employed, but how input data is manipulated by the optical reader. A few years ago, optical readers were extremely limited in formatting capability. In 1964, Recognition Equipment installed the first computing reader – an OCR system that operated completely under programmed control. Today, more and more readers are programmable.

By 1975, there will be an increased demand for broad flexibility in input formats accepted, and optical readers will have to be capable of performing a substantial amount of on-line computing as a by-product of the input process.

Wider Paper Variety

Fourth, how they handle paper. Today, there are three basic types of paper-handling devices used with optical readers: document carriers, page carriers, and journal tape carriers. There is considerable variation among the different readers in the range of sizes and weights of documents of a given type that can be handled.

By 1975, there will be a much greater need to process a variety of document types on a single OCR system, and it will be a necessity to handle a wide range of intermixed sizes and weights of documents of any given type.

What Will Product Be Like?

How will these functional requirements be packaged? What will the OCR product of the seventies be like?

Single-Face Readers

There will be several kinds of simple, limited-purpose optical readers capable of reading a single type face, or at most a very few type faces – either stylized or conventional. These readers will have limited flexibility and will require tight control over input preparation, but will be much less expensive than similar readers of the present.

Remote Readers

There will be remote readers capable of reading information directly at geographically dispersed locations. Earlier this year, we announced a new technological development called the Remote Time-Sharing Retina that will permit the use of the power of the Electronic Retina Computing Reader in applications requiring inexpensive, reliable reading at remote locations. Hundreds of terminal devices employing Remote Time-Sharing Retinas can be connected to a central recognition unit that is identical to the one in our optical readers of today – and these terminals will have the same reading reliability.

Support Products Coming

In the '70s, we will see an increase in the introduction of products that are complementary to the OCR system. Examples of this are our Ink-Jet Printer and Bar Code Reader/Sorter, which significantly increase the usefulness of our optical readers in applications requiring multiple-pass sorting of large volumes of paper documents. As these complementary products increase, we will see OCR machines becoming the central element of

(Continued on Page 5)

Letters to the Editor

Should IBM Salesmen Sue Sales Plan Author?

How strange that DPF&G, in its entitrust suit against IBM, should allege that the IBM salesman fevors e customer leasing rather than purchasing his equipment. Don't they realize that IBM remains virtually alone among computer manufecturers in its adherence to the policy of e constent potential liability to the salesman for all currently installed *leased* equipment in his territory? Most, if not all, other manufecturers ellow this liability to decrease as the number of months on rental increases, with no liability remaining efter e specified time period elapses.

Also strange to me is the allegetion by DPF&G that "e net commission of exectly $0.00" would be paid the IBM salesmen if equipment were sold rether than leased. As e former IBM salesman I can essure you that commissions *are* paid for purchese sales and are based on the equivalent rental of the equipment sold. If DPF&G refers to purchase of instelled (leased) equipment, for which transaction no commission is paid, they are reminded that commissions were previously paid when that equipment was originally sold and pieced on rentel.

As long es the chergeback liability on leased equipment remains eternelly constant and the liebility on purchased equipment remains et zero, es per IBM's sales pien, the salesman's emphasis will be weighted toward purchase. I'd say thet DPF&G is ebout 180 degrees out of phase in its ellegation.

To me a more realistic litigation would involve a suit by all IBM salesmen egeinst the person who wrote their sales plan.

J.M. Burke,
Menager

Valley Deta Services
Portland, Ore.

Virtual Memory Problem

The "virtual memory" concept in the IBM 360/67 and in the Burroughs B5500 does indeed relieve the progremmer of worrying ebout memory size and the esociated segmentation of programs, but only to e point. Some programs, if segmented arbitrarily, could run for several deys or weeks while using only e few minutes of CPU time.

Richard A. Russell
Computer Department

Badger Co.
Cembridge, Mess.

ACM's Record Keeping Defended by Secretary

As strange as it might seem, I was delighted with Carol Sampson's Viewpoint article, "ACM Reform" in the Jan. 22 issue. I hope it reflects e growing interest of the membership in the management, purposes, and goals of ACM.

However, in my capacity es secretary of ACM, I must take exception to one point. Miss Sampson states, "Although council meetings are conducted in an extremely formal manner, the minutes thet are kept are frequently unable to resolve such basic questions as what was the motion voted upon."

It is my practice to require that motions be submitted by the mover to me in writing for verbatim inclusion in the minutes. Allowance for challenging the correctness of the minutes is provided et each meeting. The problem of trying to resolve, during e meeting, what e motion was at e previous meeting on e particular subject requires a search of previous minutes which takes an expected emount of time. The infrequency of this happening does not warrent the significant efforts it would teke to index all motions by subject.

A systematic method of recording policies and procedures of ACM is being developed by the secretary and approved by the council which should surprise Miss Sampson coming from such an amateurish organization. The new ACM Policies and Procedures Guidelines should solve a pressing problem which Miss Sampson didn't fully tear into.

My only regret in writing this letter is that Miss Sampson's and my statements could not first have eppeared in an ACM news publication where it could heve been read end evaluated by the entire ACM membership. This is not meant to be a reflection upon *Computerworld* which is trying to fill the void caused by the unbalanced range of ACM publications.

D.B. Parker
Secretary

ACM
New York

Over to you, Miss Sampson. Ed.

Slip of the Typewriter

In the Jan. 15 issue on page 17 under "New Registrations," you carry Astron Corp. as being in registretion with the underwriter named, Paine, Webber, Jackson & Curtis.

Please be advised that the correct name of the company referred to is "Certron Corp." Also our official eddress is 140 Broadwey, New York, N.Y. 10005.

John Brick

Paine, Webber
New York

Bright Future Seen for OCR Systems

(Continued from Page 4)

true input systems that meet the needs of multifunction data processing installations.

Handwriting?

We can look forward by 1975 to general-purpose OCR systems capable of reeding reliebly virtually any printed type face as well as handprinting. These systems will be modular so that their configuration can be altered easily, and they will be capeble of extensive editing end on-line computing.

Multipurpose Systems

Perheps by 1975, there will be an expansion of the general-purpose OCR system into e multipurpose system including remote readers and capeble of combined batch processing, remote batch processing, and responsive remote processing.

Service Bureaus

Even earlj in the '70s, there will be e merked trend toward the use of large-scale OCR systems on e service basis. The cost of a unit operation decreases very rapidly with the increasing size of a computer in the IBM 360 series because of the law of economy of scale, which reflects the fact that the unit cost of goods or services decreases as size or volume increases. This applies also to AT&T's Dipak broadband rates. Optical readers, too, are subject to the law of economy of scale.

The use of OCR systems on e service basis will enable many companies, that, although quite large by other standards, may not have e sufficient input volume of their own to enjoy the economic benefits of optical reading.

Challenges Ahead

The years ahead offer both e challenge end an opportunity to OCR equipment manufacturers, OCR forms suppliers, and potential OCR users.

The challenge to the manufacturer is to incorporate rapidly changing technologies in new products that meet the changing needs of the user. If these products truly fill an economic need, his opportunity is to participate in one of the festest growing areas of the data processing industry.

The OCR forms supplier has the opportunity to share in this growth, too, if he accepts the challenge to constantly improve his methods and standards of quality and to incorporate in his product an understanding of the requirements of both manufacturer and user.

The challenge to the potential OCR user is to begin now to use optical reading in order to gain the experience necessary to share in the opportunity for economic benefit afforded by OCR in the seventies.

Good luck with your OCR programs!

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'Optimism Rampant, Success Elusive'

Program Transfers Need Early Planning

By Robert Berner

The problem of program transfer is such that most people think they understand the process better than they do. Optimism is rampant; success is elusive. In 12 years of hearing proponents discuss it, I have not yet seen successful mechanical translation of machine language programs. There are the processes which a translator:

- Thinks it can do and can.
- Thinks it can't do and says so, for human rework.
- Thinks it *can* do and *can't*, and therefore *doesn't say so!*

I have some tenets which I believe must be recognized:

1. Program transfer is complicated by each element which is different – user, CPU, configuration, operating system, etc.

2. Programs must be planned for transfer. "After-the-fact" is virtually useless, like post-classification for information retrieval. The information loss is too high in the transfer from programmer to code. If everyone wrote and documented his program as a connectable black box, only the connecting process would need to be under the control of the user.

3. Transfer should always be made on a source-program basis. Recompilation is a trivial expense.

4. To the highest possible degree, the documentation of the program should be self-contained in the source program itself (rather than in the auxiliary documentation), and in a standard format and placement so that mechanized program tools know where to find the machine-readable information for extraction and use.

If a suggested method of transfer meets these points, then it may be usable. But it must itself be tested to find out whether it is really acceptable, particularly whether it is documented enough.

I have a set of criteria which I think defines whether or not a unit is adequately self-documented:

"Can it be dropped into a program/data base for problem brokerage, whereupon a completely anonymous user may make a mechanical search to his requirements, find and use the module in his problem, and pay automatically a brokerage fee upon successful usage?"

This would be one standard that nobody would argue about – if he got "found" money at the end of the month for conforming. Perhaps this might be a better solution than patenting software. Only thus can the non-specialist take advantage of computer utilities.

Another well-known test of suitability is, "Does the transferred program produce the same answers as the original one?" I do not think that this is necessary in every case.

Production of identical answers is (particularly for scientific problems) an additional requirement which must be specified and held for. Differences may be due in part to differing internal arithmetic modes, but more often they are due to the over-looking of imprecision in method. On balance, obtaining different answers must be considered a healthy phenomenon.

What Do We Need?

If we must have program transfer, what needs are implied? The first need, I believe, is action on the part of the original programmer as he is writing his program. I think most of the information (program name, average runtime, etc.) should always be collected and held with the program.

Other needs can be optional. My list of needs is shown in Table 1.

Then we have to provide tools for the transfer. (To ask someone to do a job without providing him with the proper tool is silly. A workman deserves his tools – and there are some which he should have.)

And we have to prepare for the transfer – and prepare well ahead. When a program has been completed, there are a number of tools which should be created then and there to prepare for the transfer. With these in hand, the actual transfer operation becomes easier.

Many of these tools are available – but some aren't. I think that they are needed. I think that we need some way, for instance, of finding out how we arrived at some surprising result. I think we need a way of verifying the successful meeting of software interfaces. I think that we need a lot of the things which are listed in Table 2. And I would be interested in hearing from anyone who thinks that they are not necessary.

The third set of clearly important items can not come from the programmer. They can come only from the language translator or compiler. Since they are necessary, it is clear that language translators should be written for the program transfer age we are in. The processor should inspect the source program and add information to the printout of the source program to help the later use of the program. Both the original processor and later ones should do this. They should see that the source program includes certification of which language characteristics were used – and which were not used. It should also know the characteristics of its own translator – so that it can match itself to the program's needs. And it should keep the history up-to-date when different translators are used. Details of these are given in Table 3.

With this method in operation, all source programs would contain data on the minimum known characteristics required for successful processing and data on all language processors known to be able to handle the program.

Program transferability will not come easily – but it will be easier than continuing to attempt to transfer programs after they have been written without the necessary care. And the cost of transfer is growing as the years go on.

machine-readable information for extraction and use.

Viewpoint on Program Transfers

The transfer of programs from machine to machine is a necessary and apparently continuous fact of computer life. As machines come on the market and are replaced by later machines, the program investment grows and the difficulty of changing the programs so that they work on the new machines usually grows with it.

In general, the conversion task is only attacked *after* the fact. The programs are written using the hardware and the operating systems as well as they can be used. Then, sometimes years later the task of fitting these programs to another machine is undertaken by some study group whose first job is to find out just how the systems are being used.

Robert W. Bemer of General Electric believes that this is the wrong way around. After watching the process in action for 12 years, he now suggests that if we give the programmer the right tools – collect the right data and design our language processors accordingly – we will stand a chance. Here is his argument adapted from a position paper.

Table 1. Information required to transfer (run) a program. This should be collected while the program is being produced.

- Program name
  Program function
  Descriptors, classification
- Original computer system
  Original configuration, subset of required configuration, options used/available
  Other system/configurations verified to run on
- Operating system, requirements, linkages, interfaces
  Running instructions
  Store requirements (resident program, non resident program, data, tables, segmentation, overlay sequences)
- Source language (standard, dialect)
- Input/output data
  Data structures
  Data types
  Data elements, collating sequence
- Interfaces (other units called, libraries)
  Connections (via jumps, switches, natural flow)
  Language/processors equipped to call this program
- Method, average runtime (for interactive simulators)
  Restrictions, constraints, degenerate cases, idiosyncrasies
  Range, accuracy, precision
  Changes occurring in conditions, status, original input
- Optional
  Information specific to program transfer
  Default options – referring to international/national standards
  Responsible organization
  Grade of program (thoroughness of testing)
  Test cases and answers (possible autoverification and answer match)
  Bibliography, references
  Copyright, price, etc.
  Source/object program listing, number of instructions/statements

Table 2. Mechanical tools for conversion tools which the programmer should have available to be used during the completion stage of the program. This would help to protect programs transfer problems and to ensure a well-conditioned state.

- Combinatorial path exercisers through a program.
- Programs which page the source code for the programmer and mechanically force him to be up-to-date.
- Programs which mechanically check the linkage of units of a software system to provide a directed graph for flow verification, ensuring that any software unit will not interface with other software units to which it should *not* be connected.
- Mechanical determination of valid paths in the reverse direction of flow, as a diagnostic tool for finding "How did we get here from there?"
- Mechanical verification of successful meeting of interface requirements when passing from one software unit to another in a forward direction.
- Mechanical re-verification of linkage and interface requirements for any revisions.
- Code acceptance filters.
- A patch defense (correct/change in source code only).
- (De-)flowcharters.

Table 3. Items which the language translator should provide mechanically.

The source-to-object program translation process yields information. Much of this is lost, but needn't be. Some of this information concerns elements which are not themselves standardized, but can be part of a standard list of measurements useful to program transfer.

A language processor should be constructed:

- To be self-descriptive of its characteristics (*i.e.*, features contained, added or missing; dialects or differences).
- To affix to the original source program, as a certification of a kind, either an identification of, or its actual characteristics. It may also strike characteristics or features which were unnecessary for that source program.
- To inspect transferred programs for a match to its own characteristics.

If the transferred program is processed successfully:

- The identification of the new processor is also affixed to the source program.
- In any area where the new processor has lesser requirements (*i.e.*, a smaller table worked successfully; a missing feature was not required), the affixed information is modified to show the lesser requirement.

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Sympton Rating System Offered Free

By a CW Staff Writer

PERRY POINT, Md. – Psychiatric symptom patterns are identified with the aid of a computer at the Maryland Veterans' Administration Hospital here.

Every three months, nurses at the hospital rate the patients on 26 items, such as "disorganized thinking." According to Dr. Donald Gorham, chief of the Psychology Research Laboratory, the nurses' ratings are sufficient; it is not necessary for psychiatrists or clinical psychologists to do the ratings.

With the aid of a computer, these ratings can be used in two ways. First, by factor analysis: the computer looks for sets of symptoms that frequently occur together. A simple example is that disturbed thinking usually is characterized by high ratings in "suspiciousness," "disorganized thinking," and "bizarre content in thinking."

Alternately, after a symptom pattern has been determined, it is possible to rate patients on that pattern. Thus, for example, a doctor could get a measure of thinking disturbance by having the computer add weighted scores for "suspiciousness," etc.

Reports by Category

Reports can be generated listing patients according to age, diagnosis, symptom pattern, nursing care requirements, length of hospitalization, etc.

One use of symptom patterns is drug screening, according to Gorham. He told *Computerworld* that, in general, a particular drug is used for only a small grouping of patients. Thus, one does not give the same drug to all schizophrenics, but only to certain groups. The new system makes it easier for the doctors to select those patients in a certain subcategory.

Some of the ratings made by the nurses are also nursing care items, such as "can the patient bathe himself?" Adding weighted ratings for these items allows the head nurse to determine how much care each patient needs and to properly allocate her staff.

Test Year Completed

The system, called the Treatment Evaluation System, was developed by Gorham and Delta Data Systems, a College Park, Md. software firm. The system has been undergoing tests for a year and now contains four quarterly nurses' reports on each patient. The program is undergoing additional testing at the Veterans Administration Research Support Center at West Haven, Conn.

Gorham is offering the program free of charge to hospitals and medical schools. It is coded in Fortran IV and is now operational on the tBM 360/30 DOS. 65K byte memory is required.

According to Gorham, the Treatment Evaluation System can handle over 40 characteristics. These characteristics do not have to be the ones used at Perry Point, but can be anything ratable on a nine point scale.

In 1966, Dr. Gorham was selected Maryland civil servant of the year for his work in developing a computer based method for scoring the Holtzman inkblot technique.

Computers Join C&NW Railway

CHICAGO – One of the transportation industry's most advanced computer-communications networks has gone into operation over the 11,500-mile route of the Chicago & North Western Railway.

The C&NW's system – known as Fastfax – is designed to handle message switching, freight car tracing, and shipper inquiries on an automated basis, providing "a level of customer service in which we can do in seconds what used to take hours," according to John J. Kane, C&NW vice president for sales and marketing.

The system – built around four RCA Spectra 70s – collects, monitors, and transmits some 200,000 messages daily from freight yards in tt midwestern states and North Western sales offices from coast-to-coast.

The installation includes three Spectra 70/45s and a Spectra 70/35 along with 45 remote visual display units for information retrieval. Supporting these are disk memory units, tape stations, and other peripherals designed for batch processing routines as well as inquiry and response applications.

Car Inventory

The basic task of the Fastfax system is to transmit information on all rolling stock, an average of 58,000 cars daily. Car data includes car initial and number, origin-designation, shipper-consignee, and description of goods.

When a train leaves a yard, the information on specific cars is recorded on punched cards – including the next point where the makeup of the train will be altered. The message is transmitted from a remote terminal to the central computer, which automatically transmits it to the next yard.

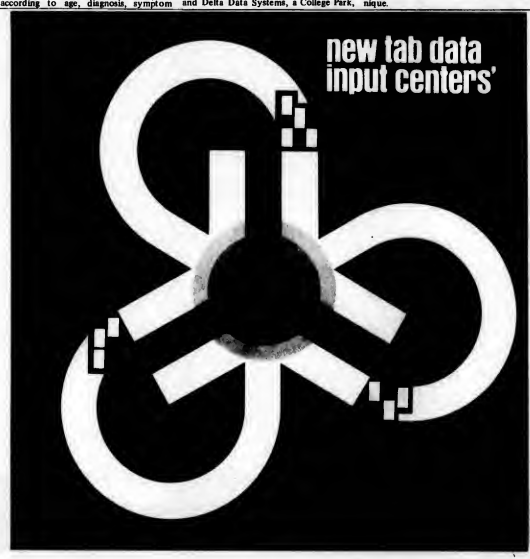
With this information, the receiving point schedules switching, manpower, and track assignments and makes operating schedules to expedite shipments. Immediate validation of data by the computer contributes to a marked decrease in erroneous transmissions over the former nonautomated system, he said.

Car Tracing

As information is received by the central computer, facts are abstracted for various management reports. Car tracing accounts for more than 70% of the customer-service inquiries received in North Western's sales offices. As the computer extracts information for management reports, it also retains the current whereabouts of each car.

The information is retrieved via RCA's Video Data Terminal. By keying in a special header number, the operator at a North Western sales office sees displayed on the CRT the two latest movements of the car.

Customers phone their requests for information to the sales offices. In turn, the sales offices query the computer over Wats lines. Railroad officials said this marked the first time that Wats service has been integrated with a computer inquiry and response operation on such a large scale in the transportation industry.



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Line of Acoustic Couplers Announced

SOUTHFIELD, Mich. – A new series of acoustic/magnetic couplers to facilitate communications between remote devices and a central computer has been announced by the Communica-

tions Equipment group of Direct Access Computing Corp.

The coupler, designated the Telemate 300, connects a conventional telephone to one of several I/O devices, according to the company. "Telemate 300 was developed to meet the fast-growing need for more flexible and versatile uses in computer and other communication fields," Robert M. Franklin, Direct Access president, said.

In initial competitive tests, reports Franklin, one of the country's largest users judged the device superior over 10 other couplers. As a result, the device won a substantial order, he said.

The device has a 300 Baud transmission rate, a half- or full-duplex switch, excellent acoustic isolation (minimum of 20 decibels), and can be interfaced to a Teletype through an Electronic Industry Assoc. standard interface. Options include a wooden carrying case, originate/answer capability, a loudspeaker, and several different cable interfaces.

Crosspoint Programmer

A new modular crosspoint programming system that has the standard two layer construction and ten decks may be used with up to three circuit paths for each contact position.

The programming pins have fully guided, closed entry contacts. The pins are guided by a precision molded module to insure that the contact springs only conduct electrical current.

The modules are individually color coded in a choice of eight colors. Delivery time is two to three weeks.

Layout sheets are available on request to aid in design and ordering. Programming Products Dir., MAC Panel Co., Box 5027, High Point, N.C. 27262.

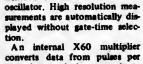
New Products

Battery Operated Terminal

A new, battery operated portable acoustic-coupled telephone computer terminal has the standard 12 button dial for sending letters and numbers and an amplifier for voice or tone responses. The unit can be attached to any ordinary telephone and will transmit data to a computer system. The inputs and outputs of the Spartan unit are identical to those from the regular 12 button phones installed by the telephone company, so there is no need for different procedures or codes.

Power is provided by ordinary radio transistor batteries. Prices start at $160 per set. Metroprocessing Corp. of America, 64 Prospect St., White Plains, N.Y. 10606.

Reciprocal-Taking Counter

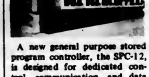


A new 20 MHz automatic reciprocal-taking counter will measure the carrier frequencies of pulsed RF or tone bursts without the use of a transfer oscillator. High resolution measurements are automatically displayed without gate-time selection.

An internal X60 multiplier converts data from pulses per second to revolutions per minute for tachometry applications.

The unit has a selection of measurement times, short times for high speed applications and long times for accuracy. Hewlett Packard, 1501 Page Mill Rd., Palo Alto, Calif. 94304.

Stored Program Controller



A new general purpose stored program controller, the SPC-12, is designed for dedicated control, communication, and data processing application; and will function in the decentralized portion of centralized-decentralized automated information and control systems.

The unit is a binary, parallel, single address processor with 4096 to 16,384 words of core memory. The memory has a pool of 64 locations which can contain 8-bit operation codes.

Software provided with the unit includes Cas and Bus. General Automation, Inc., 706 W. Katella Ave., Orange, Calif. 92667.

Cartridge Tape Recorders

Two new cartridge-loaded digital tape recorders, DS-4150 and DS-4130, have IBM compatible hubs for post-flight data processing and are available in 7- or 9-track configurations with 6-inch reels.

The DS-4130 model includes incremental recording capability for RZ or NRZ(1) inputs. The DS-4130 model contains all solid state write amplifiers and individual motors for supply and takeup reels.

Tape speed and tension are controlled by a dual differential capstan system. Data Storage Dept., Sanders Associates, Inc., 95 Canal St., Nashua, N.H. 03060.

Pollution Control

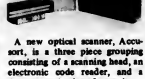
A new computer-controlled data-acquisition system monitors air and water pollution from distant sites, and can be used to measure industrial air pollution. Basic part of the system is the programmed data quantizer, a data acquisition and digital control unit.

The control unit, in combination with a teletypewriter, converts digital data into typed pollution reports. The central control unit can call up the remote unit by phone and request readout information.

Each satellite unit can be located at a plant site where air pollution is suspected and on telemetered command from the central control unit it can telemeter data back to the central control unit.

Price per station averages $15,000. Information Instruments, Inc., 62 Enterprise Dr., Ann Arbor, Mich.

3-Piece Optical Scanner



A new optical scanner, Accusort, is a three piece grouping consisting of a scanning head, an electronic code reader, and a data processing interface unit.

On-line data collected by the system can be stored on paper or magnetic tape, punched into cards, or fed directly into a computer.

For use in high volume multiplant or multi-product manufacturing, the scanning device will acquire product information from coded shipping cartons as they are automatically conveyed, and the data can be used to provide computer input. General Atronics, 1200 E. Mermaid Lane, Philadelphia, Pa. 19118.

Automatic Weigher

A new, compact high-speed weigher, compatible with all weighing systems, may be used for simple basic weighing or as a computer-controlled, unattended automatic weigh station.

It transfers reports to remote locations and is adaptable to multiple scale applications. The weighing cycle can be slowed or increased.

The unit has a solid state integrated circuit with no moving parts, and can be read directly into most recording and data office equipment. Parsons Automatic Scale Co., 1331 8th St., Berkeley, Calif. 94710.

Perforated-Tape Handler

A new perforated-tape handler, Model 6040, operates bidirectionally using NAB reels. The unit will accommodate any standard 5-, 6-, 7-, and 8-level paper tape, ranging in width from 11/16 inch to 1 inch.

"No tape" and "broken tape" interlocks monitor both the run and rewind modes and automatically remove ac power to the unit if either condition occurs. Digitronics Corp., Albertson, L.I., N.Y.

Magnetic Tape Terminal

A new computer compatible magnetic tape terminal for data communication applications is a stand alone unit which provides point-to-point data communications in a parallel format over ordinary telephone lines.

The System 4031 is compatible with Tally send and receive terminals. Error detection, retransmission, and unattended answering capabilities are included.

Hardware code translation is provided to convert between BCD paper tape, BCD magnetic tape, or 9-track EBCDIC codes, depending on the code requirements of the remote terminal. Tally, 1310 Mercer St., Seattle, Wash. 98109.

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THE PRO'S YOU NEED READ COMPUTERWORLD

Students Given Look Into EDP

BOSTON – A group of high school seniors and their parents had a chance to get some hands-on experience here this month at a free seminar given by the Academy of Computer Technology of Boston.

Among the programs demonstrated on a remote terminal was one that accepted data on the characteristics s student wanted in a school and typed out a list of schools that met the qualifications.

During the seminar on "Your Future in the Computer Industry," James Wilson and Charles Lowry, from the parent Academy of Computer Technology in Dallas, and Carl Findlay, an instructor at the Boston academy, discussed the computer field and the career opportunities in it. A sample class was then held for the students.

John Sobolesk, director of admissions, and academy secretary Nancy Mitchell demonstrate a remote terminal at the Academy of Computer Technology seminar.

Society for MIS Being Formed

LOS ANGELES – A founding committee of key EDP industry leaders has been created to establish a new professional management society.

Heading the Founding Committee for the Society for Management Information Systems are Robert V. Head, author and consultant; and M.H. Schwartz, assistant controller, Atomic Energy Commission.

"The new society is intended to fill a void, to serve as an exchange or marketplace for technical information concerning management information systems," said Head. "It is *not* intended to duplicate or overlap the work of existing societies," he added. "The objective is to provide an interdisciplinary forum for those concerned with all aspects of management information systems," Head emphasized.

The mission of the SMIS will be to foster the development of information systems for the improvement of management performance, according to co-chairman Schwartz.

The new society will serve the technical MIS information needs of management systems directors, top-level executives served by management information systems, educators in graduate schools of business, MIS resource people (doers), and members of the general public with an interest in MIS.

Other members of the committee are: Dr. James C. Emery, associate professor, Wharton School of Finance and Commerce; Robert B. Forest, Editor, *Datemation* magazine; Mel H. Gross, vice president, Esso Mathematics and Systems, Inc.; Dr. Alan J. Rowe, chairman, Department of Management, School of Business Administration, University of Southern California; James C. Rude, vice president, information systems, Pillsbury Co.; Robert G. Stevens, vice president, First National City Bank, New York; and Robert K. Wilmouth, senior vice president, First National Bank of Chicago.

calendar

Feb. 3-4, San Francisco – Computer Systems Analysis Techniques. Contact: Brandon Systems Institute, 1611 N. Kent St., Arlington, Va.

Feb. 5, Philadelphia – SCORE (Information Retrieval and Reporting System). Contact: Robert P. Wolk, Manager Software Systems, Atlantic Software, Inc., Fifth and Chestnut Sts., Philadelphia.

Feb. 13-14, Las Vegas – Adapso Management Conference. Contact: J.L. Dreyer, Adapso, 420 Lexington Ave., New York 10017.

Feb. 24-25, Washington, D.C. – IEEE Conference on "Where Technology is Leading Communications." Contact: Charles A. Meyer, Commercial Engineering Services, RCA, Harrison, N.J. 07029.

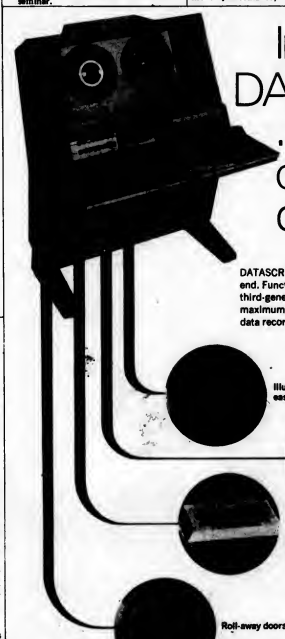
Mar. 4-6, White Sulphur Springs, W.Va. – Univac Users Association Conference. Contact: George Popp, JR, Harris Trust & Savings Bank, 111 W. Monroe St., Chicago 60690.

CALL FOR PAPERS

1969 JOINT MCAO CONFERENCE. Submit a paper concerned with mathematical and computer aspect only. Papers may discuss design methods and techniques or the development of design systems. Only papers which have not been presented or published previously should be submitted.
Send a working title by May 1 and a one page abstract by July 1 to SIAM-1969 Joint MCAO Conference, 33 17 St., Philadelphia, Pa., 19103.
Send questions regarding to the technical program to J.F. Traub, Program Chairman, Computing Science Research Center, Bell Telephone Labs., Inc., Murray Hill, N.J. 07974.

1969 IEEE COMPUTER GROUP CONFERENCE. June 17-19, Leamington Hotel, Minneapolis, Minn. Papers are solicited describing new developments in software, hardware, languages, interpretation, system organization, peripheral equipment, system models and analysis, special purpose systems.
Submit a 500-word abstract suitable for publication in the Computer Group News and a 1000-word illustrated digest suitable for publication in the Conference Digest to quadruplicate to Donald L. Epley, Program Chairman, 1969 IEEE Computer Group Conference, Dept. of Electrical Engineering, University of Iowa, Iowa City, Iowa. 52240.

ACM CONFERENCE ON APPLICATIONS OF CONTINUOUS SYSTEM SIMULATION LANGUAGES, June 30-July 1, Sheraton Palace Hotel, San Francisco. Submit papers on applications of continuous system simulation languages using digital computers.
Included would be applications using digital languages such as Mimic, Gast, IVSSO Csmp, Hytran, Dynamo, East, Simtran, Mimac.
Excluded would be discrete simulation languages, digital analog simulation languages and general scientific languages. Contact: Robert Brennan, IBM Scientific Center, 2670 Hanover St., Palo Alto, Calif. 94304.



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Affect of Delayed Announcements

The Justice Department action asks that the announcement of the development or production of any planned computer hardware or software be required to be withheld until such products had been subjected to normal testing.

Typically, computers cannot be delivered for one to three years after original announcement. Software for the system may take another year or two after that before it can be delivered. If by "normal testing" the Justice Department means testing on the machine itself, then the granting of this request would result in many more single announcements and fewer integrated ones.

In 1964, for instance, instead of announcing the whole line of 360s together with software, there would probably have been only an announcement of the 360/30 hardware (which was then available, though not ready for delivery). IBM probably could not have announced the Operating System 360 nor the New Programming Language (as PL/I was then called). Those announcements would have been followed by those for Models 40 and 50 in 1965 and of the Model 65 about 1966. The Models 60, 62, 64, and 70 probably would never have been announced, and the Model 85 would have only been announced last fall. Whether or not the Model 90s would have even been announced is not clear, as by the time they had been tested their performance had dropped, and their price/performance characteristics might have been unmarketable.

In the software area, the Operating Systems 360 would have been announced in at least two different parts with multiprogramming with a fixed number of tasks announced in 1966 and multiprogramming with a variable number of tasks not announced until 1968.

Model 67 Problem, Too

The situation of the Model 67 and TSS software would have been even more complex. The original claim that it was eight times as powerful as a 7094 could not have been made unless the Justice Department allowed simulation to be considered "normal testing." It is probable that the 360/67 with software could not have been announced before 1968 with any capability that was at all reasonable, and it might well have not been announced then, as by that time the actual performance of the system might not have been a marketable commodity.

Users Left in Doubt

The result of this would-be that a user trying to plan ahead would have to work much harder because he might have little idea as to what IBM planned for the next year. When the Model 30 user got his system in, he might not have known he was able to go to a 40 – or even that a 40 was on the planning board. However, this could have been obviated to some extent by an announcement that the Model 30 was the first of a family, in the way Univac, NCR, and other companies have habitually announced their computer systems.

Better Documentation

On the other hand, when he did get the announcement, it would be firm so that the user would not have to handle the doubts or difficulties, wondering how the actual products would turn out. This would mean that rush orders for additional core or for more powerful systems would occur to the extent that they have in the past and that there would be a closer relationship between the planning and the final results.

Suits Are Different

One difference between the present Justice Department suit and the previous one in 1952 is that no allegations are made that IBM has a worldwide monopoly. The complaint simply deals only with the U.S. situation. In 1952 the complaint was against the worldwide performance of IBM as is the current Control Data antitrust suit.

The antitrust acts cover both the operation of companies within the United States and the operations of American companies outside it.

IBM Reacts to New Antitrust Suit

Special to Computerworld

While IBM largely ignored the Control Data and DPF&G suits after issuing initial denials, it reacted strongly to the Justice Department suit.

First sent letters to all its stockholders which, in addition to containing the same text as its public denial, ended with this statement:

". . . And that [IBM believes] that the fundamental outlook for IBM's future continues to be very good."

The letters were followed by a two-page ad taken in an unknown number of newspapers across the country on Jan. 22. The ad was headed, "Has IBM Spoiled the Computer Business for Others? Let's Look at the Record."

Meanwhile, IBM's stock, which closed at 307-1/2 on the New York Stock Exchange just before the suit was announced, dropped to 293 after the announcement but recovered to close at 300.

Problems of Separate Support

By a CW Staff Writer

The Justice Department suit specifically requests that IBM should sell or lease separately the general-purpose digital computers, peripheral equipment, software, and other customer support which it offers to its customers.

The provision that peripheral equipment should be priced and provided separately from the digital computer is not surprising. Indeed it currently is generally sold in that way. Nor to some extent is it a surprise that the suit requests that computer software be sold separately. The announcement last month by IBM that it was reconsidering all of its marketing policies had been widely taken to be a foreshadowing of separate pricing for software. The surprise element was the requirement that other customer support which it offers also should be priced separately.

More to Think About

From a user's point of view, this would mean that he would have to consider more separate items in his purchase order and to pay for them. But he also would get more. Currently, as there is no payment for support and software services, there is no definition of the cost. In its antitrust suit, DPF&G argues that it was very hard for a customer to find out what support he had available to him. If the courts agree with the Justice Department IBM will have to provide specifications and prices for its software. This would mean that the user would be able to shop better.

Particularly impacted would be the support which IBM offers in the form of programming for some of its customers. Industry sources argue that this is a valuable subsidy being given on a discriminatory basis which adversely affects many of the software companies and some of the other computer manufacturers.

The amount of programming which is to be given in this way is generally left up to the branch managers. IBM has argued in the past that it is not its policy to provide programming services and that it does so only as a part of its marketing effort.

Violations Wouldn't Be Easy to Prove

A number of the requests that the Justice Department has made in its suit are very hard to interpret and apparently would be even harder to enforce unless some guidelines can be developed. Generally these requests ask that IBM be prevented from particular types of conduct which "have the purpose or the effect of continuing, revising, or renewing" some violation of the antitrust acts.

The problem lies in defining in any specific case whether such conduct does have any such results. If it takes 10 years after a suspected occurence before it can be seen that there has been such a result, then simply forbidding IBM from taking part in such operations might not have the intended result.

Within this great area lie many items which are of interest to the user. One request, for instance, asks that IBM be restricted from claiming any rights which it may have under contract, agreements, tactics, or understanding. If, for instance, a user has a contract with IBM which restricts his ability to attach non-IBM equipment to his IBM system, and if such restrictions are found in violation of the antitrust acts (one very big if), then, although the contract could be continued in apparent force, IBM could be forbidden from enforcing the restriction. This compliance, in turn, would be very hard to enforce, and it might be easier to try to get the contracts rewritten to match the actual position.

Other difficulties would be involved in the educational area where research grants, buy-backs of computer time would be forbidden where the effects of such practices would be to inhibit the entry or growth of competitors.

Text of Justice Department Suit Against IBM

UNITED STATES DISTRICT COURT
FOR THE SOUTHERN DISTRICT
OF NEW YORK

UNITED STATES OF AMERICA,

Plaintiff,

v.

INTERNATIONAL BUSINESS
MACHINES CORPORATION,

Defendant.

COMPLAINT

The United States of America, by its attorneys, acting under the direction of the Attorney General of the United States, brings this action against the defendant named herein and complains and alleges as follows:

JURISDICTION AND VENUE

1. This complaint is filed and this action is instituted against the defendant under Section 4 of the Act of Congress of July 2, 1890, as amended (15 U.S.C. §4) commonly known as the Sherman Act, in order to prevent and restrain the continuing violation by the defendant, as hereinafter alleged, of Section 2 of the Sherman Act (15 U.S.C. §2).

2. Defendant International Business Machines Corporation has offices, transacts business and is found within the Southern District of New York.

DEFENDANT

3. International Business Machines Corporation, hereinafter referred to as "IBM", is made a defendant herein. IBM was organized under the laws of the State of New York in 1911 and assumed its present name in 1924.

4. IBM is the largest manufacturer of information handling systems in the world. It develops, manufactures and markets electronic and punched card data processing machines and systems, as well as electric typewriters, dictation equipment, and related supply items. In 1967 IBM had total revenues of $3,345,291,000 with total assets of $3,594,670,000 and net income of $651,500,000.

5. IBM conducts its worldwide business through 11 divisions and three subsidiaries. The Service Bureau Corporation, a wholly-owned, but independently operated subsidiary, furnishes data processing services on a fee or contract basis to its customers in the United States. Science Research Associates, Inc., acquired by IBM in 1964 and now operated as a wholly-owned subsidiary, develops and markets instructional and guidance materials and a wide variety of intelligence, aptitude and achievement tests. IBM World Trade Corporation, another wholly-owned subsidiary, conducts all of IBM's business, except that of Science Research Associates, Inc., in over 100 countries outside the United States.

TRADE AND COMMERCE

6. As used herein, a computer is an electronic device which processes information as desired by activating electronic impulses in pre-defined sequences. Digital computers, which represent over 95% of all computer sales and leases, are machines which process information which is symbolized by numerals and processed in that form.

7. A computer system, sometimes referred to as an electronic data processing system, consists of a machine or a group of automatically intercommunicating machine units capable of entering, receiving, storing, classifying, computing and/or recording data, which system includes at least one central processing unit and one or more storage facilities, together with various input and output equipment.

8. Computer hardware includes all the physical components used in a computer system. Computer software includes the programming know-how and materials necessary to make the computer hardware operative. Computer support includes all manpower and other assistance necessary to make and keep the computer hardware and software operative.

9. The general purpose digital computer is one which has general commercial application and is offered for sale or lease in standard model configurations. Special purpose digital computers are designed

(Continued on Pag 11)

Text of Justice Department's Suit

(Continued from Page 10)

for particularized needs or purposes and are produced for use by a limited number of customers but not made generally available to all customers.

10. The computer industry is an extension or outgrowth of the electrical tabulating industry. Electrical tabulating machines are devices for recording on a unit basis, and automatically classifying, computing and printing alphabetic and numeric accounting and statistical information by controlled electrical means. IBM was originally organized as the Computer-Tabulating-Recording Co. and from 1911 to 1933 it owned a majority of the capital stock of, and controlled, The Tabulating Machine Company, a corporation organized in 1905 under the laws of the State of New Jersey. During this period IBM operated in the tabulating field through The Tabulating Machine Company, which was merged with IBM in 1933. The tabulating business continued to represent the major product line of IBM until the advent of the electronic computer in the 1950's.

11. In 1932 the United States filed a civil antitrust suit against IBM and Remington Rand, Inc. charging that they had unreasonably restrained and monopolized interstate trade and commerce in tabulating machines and tabulating cards by entering into agreements in which they agreed:

(a) to lease only and not sell tabulating machines;

(b) to adhere to minimum prices for the rental of tabulating machines as fixed by IBM, and

(c) to require customers to purchase their card requirements from the lessor or pay a higher price for the rental of machines.

The agreements between IBM and Remington Rand, Inc. were cancelled in 1934 prior to the trial of that suit, and the issues presented by the agreements were withdrawn from the case. The lease provision requiring the lessees to purchase cards from the lessor was adjudged to be illegal by this Court. (13 F. Supp. 11, affirmed 298 U.S. 131).

12. On January 21, 1952 the United States filed another civil antitrust suit against IBM charging that it had violated Sections 1 and 2 of the Sherman Act by attempting to monopolize and monopolizing interstate trade and commerce in the tabulating industry. The complaint alleged that IBM owned more than 90% of all the tabulating machines in the United States and manufactured and sold about 90% of all tabulating cards sold in the United States. This suit was terminated by the entry of a consent judgment by this Court on January 25, 1956 (Civil Action 72-344).

13. Although a few experimental computers were assembled during the late 1940's, the general purpose digital computer did not have its beginning until the early 1950's. The first installations of general purpose digital computers were made by Remington Rand, Inc. beginning in 1951. IBM followed with its first general purpose digital computer being produced and delivered near the end of 1952.

14. Remington Rand, Inc., which was later merged with Sperry Corporation to form Sperry Rand Corporation, took the early lead in the development and sale of general purpose digital computers. However, IBM surpassed that company in the sales of such computers by the late 1950's. Both companies' early activities in the general purpose digital computer marketplace were regarded primarily as extensions of their earlier activities in the tabulating industry. The prior customers for the tabulating machinery presented an inherent source of potential users of general purpose digital computers.

15. The computer industry has been one of tremendous growth. By 1955 some 400 computers had been installed in the United States. By 1960 the number of installations approximated 6,000 and by the end of 1967 the number of computer installations exceeded 43,000. In terms of total revenues from the sale or lease of general purpose digital computers, the industry has been an increase from approximately $600,000,000 in 1961 to in excess of $3,000,000,000 in 1967.

16. IBM's total revenues from the sale or lease of general purpose digital computers in the United States increased from $506,668,000 in 1961 to $2,311,353,000 in 1967. During this period of time IBM's share of total industry revenues of these products varied from approximately 69% to approximately 80%. In 1967 IBM's share of such revenues was approximately 74%. Its nearest competitor in 1967 had revenues of approximately $156,000,000 or 6% of the total.

17. Approximately 76% of the value of all general purpose digital computers shipped in the United States in 1967 were shipped by IBM while its two nearest competitors together accounted for about 8% of such shipments. At the end of the same year, approximately 67% of the value of all installed general purpose digital computers in the United States was represented by machines that had been manufactured by IBM.

18. IBM manufactures general purpose digital computers at its plants located in Poughkeepsie and Endicott, New York, and manufactures parts, components and subassemblies at numerous other plants in the United States. Such computers and related products are shipped to customers located throughout the United States.

OFFENSES

19. Beginning in or about 1961 and continuing up to and including the date of the filing of this complaint, the defendant has attempted to monopolize and has monopolized the aforesaid interstate trade and commerce in general purpose digital computers in violation of Section 2 of the Sherman Act (15 U.S.C. § 2). Said offenses are continuing and will continue unless the relief hereinafter prayed for is granted.

20. Pursuant to and in furtherance of the aforesaid attempt to monopolize and the monopolization, the defendant has pursued a manufacturing and marketing policy that has prevented competing manufacturers of general purpose digital computers from having an adequate opportunity effectively to compete for business in the general purpose digital computer market, and has done, among other acts, the following:

(a) Maintained a pricing policy whereby it quotes a single price for hardware, software and related support and, thereunder, (i) discriminated among customers by providing certain customers with extensive software and related support in a manner that unreasonably inhibited the entry or growth of competitors; and (ii) limited the development and scope of activities of an independent software and computer support industry as a result of which the ability of its competitors to compete effectively was unreasonably impaired;

(b) Used its accumulated software and related support to preclude its competitors from effectively competing for various customer accounts;

(c) Restrained and attempted to restrain competitors from entering or remaining in the general purpose digital computer market by introducing selected computers, with unusually low profit expectations, in those segments of the market where competitors had or appeared likely to have unusual competitive success, and by announcing future production of new models for such markets when it knew that it was unlikely to be able to complete production within the announced time; and

(d) Dominated the educational market for general purpose digital computers, which was of unusual importance to the growth of competitors both by reason of this market's substantiality and by reason of its ultimate impact on the purchasing decisions in the commercial market, by granting exceptional discriminatory allowances in favor of universities and other educational institutions.

EFFECTS

21. The aforesaid offenses have had, among other things, the following effects:

(a) The defendant has monopolized and continues to monopolize the general purpose digital computer market in the United States;

(b) Actual and potential competition in the manufacture and marketing of general purpose digital computers in the United States has been restrained; and

(c) Competitors of IBM have been improperly deprived of the opportunity to earn competitive profits on their general purpose digital computers and actual and potential competitors have been discouraged from entering or continuing in the business of manufacturing and marketing general purpose digital computers.

PRAYER

WHEREFORE, the plaintiff prays:

1. That the Court adjudge and decree that the defendant has attempted to, and did monopolize interstate trade and commerce in the general purpose digital computer industry in violation of Section 2 of the Sherman Act.

2. That the defendant and all persons, firms, and corporations acting in its behalf or under its direction or control be permanently enjoined from engaging in, carrying out, or renewing any contracts, agreements, practices, or understandings or claiming any rights thereunder, having the purpose or effect of continuing, reviving, or renewing the aforesaid violation of the Sherman Act, or any contract, agreement, combination or conspiracy having like or similar purpose or effect.

3. That the defendant hereafter be required to price separately and to offer to sell or lease separately, and to sell or lease separately to any applicant upon such terms and conditions as the Court may direct (a) general purpose digital computers; (b) peripheral equipment; (c) computer software; and (d) other customer support which it manufactures or offers to its customers.

4. That the defendant hereinafter be required to refrain from the use of special allowances, buy-backs of computer time, or research grants, in the sale or lease of any and all general purpose digital computers, peripheral equipment, computer software and other customer support equipment or services which it manufactures or offers to any of its customers, where the effect of such practices may be unreasonably to inhibit the entry or growth of competitors.

5. That the defendant hereinafter be required to refrain from entering into the production of computer hardware which is not likely to result in returns reasonably related to returns from other computer hardware products sold or leased, or which could be sold or leased, by the defendant.

6. That the defendant hereinafter be required to refrain from the announcement of the intended necessity of production of any planned computer hardware or software until such product has been subjected to normal testing.

7. That the plaintiff have such relief by way of divestment, divestiture and reorganization with respect to the business and properties of the defendant as the Court may consider necessary or appropriate to dissipate the effects of the defendant's unlawful activities as hereinbefore alleged in this complaint, and to restore competitive conditions to the general purpose digital computer industry.

8. That the plaintiff have such other and further relief as the nature of the case may require and the Court may deem proper in the premises.

9. That the plaintiff recover the costs of this suit.

IBM Denies Charges, Calls Suit 'Unwarranted'

ARMONK, N.Y., Jan. 17 — International Business Machines Corporation said today it will defend itself forcefully against charges by the Department of Justice that it is monopolizing the data processing industry. IBM said it believes the government's action to be unwarranted and without foundation.

The company's statement said:

"This lawsuit is the outgrowth of the previously reported discussions which have been going on for nearly three years between the Department of Justice and various companies in the data processing industry. IBM has cooperated fully in this review.

"One of the key issues in these discussions has been whether there is sufficient competition in the data processing industry or whether IBM has such monopolistic power that fully effective competition does not exist.

"Evidence of the open and strongly competitive nature of the computer business is abundant. Virtually nonexistent 20 years ago, it has grown into a multibillion-dollar industry that has attracted more than 60 manufacturers of computer systems and some 4,000 companies dealing in related equipment, support, and services.

"New companies as well as major and well-established ones have been freely and effectively entering the industry, whether they have a competence in electronics, a background in business machines, or simply a technical innovation which can be developed into a business. Technological advances have come at a very rapid rate, and from all corners – not just from IBM.

"Despite this evidence of strong and increasing competition, the Government has decided to bring this suit.

"IBM will defend itself forcefully against this action, which it believes is unwarranted and without foundation. The company believes, furthermore, that the highly competitive data processing industry will remain a growing and dynamic one."

Latest Version of 'Basic' Provides More Flexibility

By a CW Staff Writer

PHOENIX, Ariz. – Usera of Basic, the time-sharing language developed at Dartmouth College, now have a new version of Basic available, according to the developer, Pillsbury Management Systems Co.

The new version permits several extensions over the standard Basic, and a few over Extended Basic, according to the company.

Set Command Useful

Users should find one particular new language command extremely useful, according to company vice-president Robert W. Callan. The "SET" command allows users to format their output reports with simple instructions, giving as much flexibility as that available with Fortran.

The command for SET is: SET (single letter) = (expression), (left options), (right options). The statement allows the programmer to specify the number of characters to the right and to the left of the decimal point (a maximum field width of nine significant characters) with several data representations possible.

Other New Features

With the new Basic, there is no limit to the maximum size of the source program other than those imposed by machine size. In standard Basic, the limit is 240 source statements.

It is also possible to continue statements over several lines, up to a total of 200 characters, by using a colon (:) to indicate continuation. It is also possible to put several source statements on the same line, rather than one per line, as previously.

The addition of the computed "GO TO" statement enables the programmer to eliminate several types of lengthy routines to determine the next execution point in a program, and is also available with the "IF" statement as a new option.

The inclusion of all the string data functions, permitting character string manipulation, and the use of the full "TAB" statement, permit the user all the flexibility desired, with the same features present in Dartmouth's Extended Basic, the company claims.

Call Command Important

The "CALL" command has been included to permit the normal calling of Basic subprograms and subroutines from the program, and the "CHAIN" command. This allows the programmer to execute a series of programs in sequence and permits much larger programs to be executed in segments, the company believes.

The Same Goals as Kurtz

"We have made an earnest attempt to simplify and enhance the language within the fundamental philosophy of the original version by (Professors) Kemeney and Kurtz," stated Callan.

The compiler is currently available for the GE 265, and has been installed on several such systems. The company plans to expand the language to other machines in the near future, Callan further stated.

Navy Personnel Analysis System Produces and Updates Reports

SAN DIEGO, Calif. – Personnel analysts may now apply a computer-oriented system for producing and updating task analysis reports, according to a release from the U.S. Navy Personnel Research Activity.

The release (AD-677 794) from the Clearinghouse for Federal Scientific and Technical Information includes an instructional manual containing detailed guidance on the data-processing technique for performing personnel analysis and producing and updating the desired diagrams.

The diagrams can be used by personnel responsible for system design, equipment design, work design, and the preparation of training curricula and materials, the Navy said.

Financial-Report System Developed For Farmers, Agricultural Firms

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DAVIS, Calif. – Farmers and businesses engaged in agricultural activities may now make use of a financial management and analysis system released by Ag-Data, Inc.

The system is designed to provide farmers and related businessmen with six management, six financial, and six analytical reports.

Input formats and coding are completely flexible, according to the company. There are additional optional reports which make it applicable to farmers, CPAs, banks, and dealers in agricultural equipment.

The package is written in Cobol and can be run on either the IBM 360/30 or 40. The program has been operational for a year, the company said.

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GE Computer Earnings Up, But Area Still Unprofitable

NEW YORK – Despite an estimated 8% climb in sales for General Electric Co., profit for 1968 fell "no more than about 2% below" 1967 levels, according to Fred J. Borch, chairman and chief executive officer.

GE earned $112 million, or $1.24 a share in 1967's fourth quarter, bringing the net income for that year to $361.4 million, or $4.01 a share.

Although GE had a 7% increase in net income in the first 1968 quarter from a year earlier, second quarter net fell about 14% due to the income surtax and losses from the nuclear-energy and computer operations. After a very slight gain in third quarter net, earnings for the first nine months were $234.3 million, or $2.60 a share, down 6% from a year before.

The GE chairman said the company was entering a phase in which the negative impact on earnings of new ventures such as data processing equipment "will diminish and in which our investments will progressively begin to bear fruit."

Jack S. Parker, a new vice chairman, whose responsibilities cover the company's computer business, said that related revenues increased more than 20% in 1968. He said that since most computers were obtained by leases rather than sales, the company was trying to balance its rate of growth with revenues.

"Some divisions are already profitable," he said, but he declined to say when the entire computer operation would be profitable although this might come about "in a relatively short period of time."

Parker said he was "very pleased" with the improvement in one of its unprofitable computer operations – the French company owned jointly with Compagnie des Machines Bull.

Chairman Borch said that if credit remained tight and the surtax was retained, the nation's economic growth in 1969 would only be moderate.

He noted that GE faced a special problem in that the company's three-year contracts with labor unions representing many employees expire 1969.

$18.2 Million In SSI Stock Is Snapped Up

NEW YORK – Investors gobbled up $18.2 million of an SSI Computer Corp. stock offering recently, but the money is going to IBM.

The San Francisco lessor of computers and related equipment plans to use the proceeds to buy additional IBM 360s.

The offer was a combination of $15 million of 20-year debentures plus 105,000 common shares and warrants to buy an additional 300,000 common shares.

The securities were offered in 15,000 units, each containing $1000 face amount of debentures plus seven common shares and warrants to buy 20 additional shares. Each unit was priced at $1212 for an indicated overall market value of about $18.2 million.

The units cannot be broken up until May 1 when warrant holders become eligible to buy the additional common at $29 a share through Jan 15, 1979.

The company has an option to redeem the debentures which may be used as payment on common shares covered by the warrants at prices declining from an initial level of 106.75.

Control Data Goes After Canadian Computer Firm

MINNEAPOLIS – Control Data Corp. is planning to acquire Computing Devices of Canada Ltd., a subsidiary of Bendix Corp., through an exchange of $23 million of CDC stock.

The exchange offer is subject to the condition that 90% of the outstanding shares of Computing Devices is tendered, according to CDC.

Five shares of Computing Devices common would be exchanged for one share of CDC common. If the offer is accepted by all Computing Devices holders, CDC will issue 155,000 shares of common.

Computing Devices produces electronic aviation and oceanic systems and instruments. For fiscal 1968, ended Sept. 30, the company reported profit of $700,000 or 91 cents a share on revenue of $23 million.

Bendix owns 66-3/4% of the 775,000 outstanding shares of Computing Devices. CDC said that if the transaction goes through, Bendix will receive 103,462 shares of CDC's common, resulting in an extraordinary income to Bendix of about $7 million after Canadian and U.S. taxes.

The Bendix executive committee has approved the basis of the proposed offer, subject to a favorable tax ruling, and the directors of Computing Devices will unanimously recommend the offer according to CDC.

Field Services Combined By Computer Industries

SHERMAN OAKS, Calif. – Computer Industries, Inc., a subsidiary of University Computing Co., has established a field services division to combine the company's graphic systems division and its data communication systems division. Bert R. Harrigan has been appointed vice president and general manager of the new division which is set up to provide EDP systems maintenance capability for equipment of all other manufacturers and users as well as that of CII.

Compumedic Forms Personnel Branch

NEW YORK – Compumedic Controls Corp., a computer software consulting company, announced the formation of George Manos Personnel. The new division will recruit computer oriented technicians.

Western Operations Adds Honolulu Area

SAN FRANCISCO – Western Operations, Inc. of San Francisco has formed a subsidiary, Western Operations Pacific, Inc. Honolulu, as a computer service company. An IBM 360 will be used to provide services to Honiron, Inc., under a facilities management contract.

Intertech Now in Orlando

HUNTSVILLE, Ala. – Intertech Research Services, Inc. a computer services company, has opened a regional sales office in Orlando, Fla. to supervise sales of the company's offices at Cape Kennedy and Miami. William B. Selsh, Jr. has been named regional sales manager.

Automated Expands in NY

NEW YORK – Automated Concepts inc., a computer services company, has opened a new office at 50 E. 42nd St. to house its management sciences, programming sciences, and information systems divisions.

ITT Opens Midwest Center

CHICAGO – ITT Data Services has opened a computer service center here which will offer time-sharing, programming, and conventional "batch" data processing services using an IBM 360/50 computer. It is planned to operate the center around the clock, seven days a week. President of the division is Robert A. Leonard.

Bunker-Ramo Breaks Ground

WESTLAKE, Calif. – The Bunker-Ramo Corp. has started construction of its new Defense Systems Div. headquarters facility here. Completion of the $8 million installation is scheduled for the end of 1969. The company's R&D and production and fabrication operations will be located in the new facility.

Cybermetics to Serve D.C.

FORT LEE, N.J. – J. Roy Morris, president and chief executive officer of Cybermetics, announced the opening of a Washington, D.C. office to serve federal government departments and agencies. Michael Salter has been appointed Director of Plans and Programs. Cybermetics is a software and services company.

COMPUTERWORLD

financial

Levin-Townsend Plan to Acquire Insurance Company Is Dropped

NEW YORK – The Securities and Exchange Commission has squashed Levin-Townsend's unpublicized plan to gain control of INA Corp., an insurance holding company.

After consultation with the SEC, Howard S. Levin, president of Levin-Townsend, issued a brief statement saying the company had "abandoned its plans to make an exchange offer to INA stockholders" because "there wasn't sufficient time to compiy with SEC proxy requirements in making the offer."

It appears that Levin-Townsend intended to tell INA shareholders that it would exchange securities valued at $60 for each INA common share, if they would reject INA's proposed acquisition of World Airways.

Any attempt to influence the voting of INA shareholders would require a formal registration of detailed information and clearance by the SEC, a process that can take many weeks.

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COMPUTER STOCKS: TRADING SUMMARY

Week Ended January 24, 1969

EXCHANGE	BASE PRICE 1968-69 CLOSING 3-1-68	RANGE	PRICE	COMPUTER SYSTEMS	WEEK NET CHANGE	WEEK % CHANGE	% CHANGE FROM BASE
OTC	20 1/2	24 — 17	17 3/4	• Burroughs	— 1/4	— 1.39	— 13.54
OTC	11	11 — 6	6	Datamo Radio	+ 2 5/8	+ 4.14	— 8.56
OTC	16 1/4	17 — 9	16 1/4	• Control Data	+ 2 5/8	+ 6.38	+ 64.04
OTC	100	175 — 96	96	• Digital Equipment	+ 1/2	+ 1.19	+ 44.07
OTC	—	— — —	—	• Electronic Associates	+ 2	+ 15.38	+ 53.85
NYSE	87 1/4	100 — 81	90 5/8	General Electric	+ 1/4	+ 0.28	+ 3.17
NYSE	60	91 — 59	83 1/2	Hewlett-Packard	+ 1 5/8	+ 1.98	+ 39.16
NYSE	93 1/8	144 — 89	109 1/4	• Honeywell	+ 1/2	+ 0.46	+ 28.99
NYSE	208 1/2	375 — 280	299 3/4	IBM	— 7 3/4	— 2.57	+ 3.90
NYSE	103 7/8	153 — 40	112	• NCR	— 1 3/8	— 1.22	+ 7.92
NYSE	66 7/8	82 — 66	66 7/8	• RCA	— 3 5/8	— 5.14	— 0.27
OTC	39 1/8	53 — 44	48 1/2	Raytheon	+ 3 5/8	+ 8.07	+ 23.96
OTC	37 1/2	50 — 34	46	Sci. Control Corp.	+ 2 1/2	+ 5.64	+ 64.46
NYSE	79 3/4	114 — 76	90	• Scientific Data	+ 3	+ 3.45	+ 14.29
OTC	48	58 — 48 1/2	54	Sperry Rand	+ 3 5/8	+ 7.19	+ 34.44
NYSE	32 1/2	39 — 26	30 5/8	• Systems Eng. Labs	+ 1/2	+ 1.63	+ 31.64

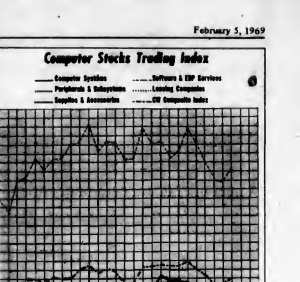
EXCHANGE	BASE PRICE 1968-69 CLOSING 3-1-68	RANGE	PRICE	PERIPHERALS & SUBSYSTEMS	WEEK NET CHANGE	WEEK % CHANGE	% CHANGE FROM BASE
NYSE	20 3/8	28 — 16	17 1/8	Addressograph-Multigraph	— 1/4	— 1.39	+ 17.12
OTC	21	99 — 62	93 1/2	Alphanumeric	— 2 1/2	— 3.79	+ 308.36
NYSE	29	61 — 26	35 1/8	Ampex	— 5/8	— 1.75	+ 29.86
OTC	17 1/8	87 — 14	18 1/2	Bell, Boreman & Newman	+ 1 1/4	+ 7.25	+ 7.25
NYSE	13 1/2	16 — 12	15 5/8	Bell & Howell	+ 1/8	+ 0.79	+ 21.28
AMSE	12 1/8	50 — 27	32 1/2	• CalComp	— 1 3/8	— 4.10	+ 1.17
OTC	24 1/2	49 — 20	35	Cognitronics	— 3 1/2	— 9.10	+ 42.86
OTC	12	12 — 10	11 5/8	Computer Equipment	— 1 5/8	— 12.24	+ 21.87
AMSE	15 1/4	25 — 13	24	• Data Products	— 7/8	— 3.70	+ 57.37
OTC	19 1/4	27 — 16	20 1/2	• Digitronics	— 1/4	— 1.44	+ 3.50
OTC	39	57 — 32	57	• Electronic Memories	— 5	— 8.09	+ 46.16
OTC	10	29 — 9	12 3/8	• Fabri-Tek	+ 6/8	+ 5.32	+ 23.75
OTC	20 5/8	35 — 15	34 3/4	Farrington Mfg.	— 1	— 2.80	+ 53.94
OTC	12 1/2	26 — 10	21	Information Displays	— 1/2	— 2.39	+ 68.08
AMSE	16 7/8	32 — 14	32 1/8	Mtge Electronics	— 5/8	— 1.91	+ 90.50
AMSE	57 1/2	108 — 54	66	• Mohawk Data Sciences	+ 7/8	+ 1.34	+ 14.72
OTC	74	76 — 71	114	• Optical Scanning Corp.	+ 2	+ 1.76	+ 54.00
OTC	18	42 — 16	27	Photon	— 1 1/4	— 5.00	+ 50.00
AMSE	25 5/8	38 — 12	33 1/8	• Potter Instrument	+ 1 1/2	+ 5.16	+ 29.21
OTC	40 1/4	95 — 38	72	Reconition Equipment	+ 1/2	+ 0.70	+ 80.20
AMSE	18	20 — 14	20 1/8	Xicon Electronics	— 1/8	— 0.87	+ 68.22
NYSE	46 1/8	65 — 34	52	Xerox	+ 3 1/2	+ 7.29	+ 25.58
OTC	47	155 — 53	90	Zenith Data	—	—	+ 70.21
OTC	20	31 — 20	31 1/2	• Addy Corp.	— 1/2	— 2.00	+ 22.40
NYSE	242 1/4	321 — 229	261 3/8	• DCS	+ 1 7/8	+ 0.71	+ 9.64

EXCHANGE	BASE PRICE 1968-69 CLOSING 3-1-68	RANGE	PRICE	SUPPLIES & ACCESSORIES	WEEK NET CHANGE	WEEK % CHANGE	% CHANGE FROM BASE
OTC	4 1/2	6 — 3	4	• Acme Visible	+ 4	+ 9.81	— 5.18
NYSE	20 1/2	32 — 18	20 1/8	Adams-Millis	—	—	— 1.26
OTC	13 5/8	28 — 13	20	• Baltimore Business Forms	— 1/2	— 2.00	+ 83.41
AMSE	27	44 — 21	27 1/4	• Barry Wright	— 3/8	— 2.60	+ 0.92
OTC	34 3/4	44 — 32	37 1/2	Data Documents	+ 4 1/2	+ 13.63	+ 8.00
OTC	27 1/4	44 — 26	40	• Ennis Business Forms	+ 1/2	+ 1.27	+ 46.79
NYSE	44 1/8	51 — 34	50 1/2	• 3M Company	— 2 5/8	— 4.94	+ 14.45
NYSE	58	93 — 48	71	Memorex	— 2	— 2.77	— 22.41
OTC	27 1/4	33 — 25	32 7/8	• Moore Business Forms	— 1/8	— 0.60	+ 20.64
OTC	27 1/4	33 — 25	32	Paisley Corp.	— 1/8	— 0.80	+ 26.40
OTC	31 1/8	66 — 40	42	Reynolds & Reynolds	+ 1	+ 2.44	+ 34.46
NYSE	34 1/2	42 — 34	37 3/4	• Standard Register	— 1/4	— 0.65	+ 19.87
NYSE	37 3/4	44 — 30	32	• Uarco	— 1 1/2	— 4.48	+ 18.86
AMSE	14 1/4	24 — 14	21	• Wabash Magnetics	+ 1 7/8	+ 10.34	+ 4.83
OTC	28 3/4	67 — 24	29 1/4	• Wallace Business Forms	— 1/4	— 1.00	+ 18.44

EXCHANGE	BASE PRICE 1968-69 CLOSING 3-1-68	RANGE	PRICE	SOFTWARE & EDP SERVICES	WEEK NET CHANGE	WEEK % CHANGE	% CHANGE FROM BASE
OTC	7 7/8	8 — 7	7	Advanced Computer Techniques	+ 1/4	+ 1.96	+ 73.53
OTC	17	36 — 14	34	• Applied Data Research	+ 1/2	+ 1.49	+ 100.00
OTC	18 1/2	23 — 13	23	• Aydas	— 1	— 4.50	+ 22.83
AMSE	47	76 — 42	73	Automatic Data Processing	+ 3 1/4	+ 4.68	+ 55.31
OTC	4	13 — 4	13 3/4	Automation Sciences	— 1/2	— 4.09	+ 193.00
OTC	4 1/2	23 — 3	15 1/4	Brandon Applied Systems	+ 1/2	+ 3.39	+ 239.20
AMSE	22 7/8	43 — 19	19 5/8	Computer Applications	— 3/8	— 1.87	+ 96.25
OTC	3	15 — 7	13	Computer Environments	+ 1 1/4	+ 13.04	+ 160.00
OTC	30	64 — 24	55	Computer Network	+ 15	+ 37.50	+ 83.33
OTC	40	64 — 36	64 3/4	Computer Sciences	+ 5 1/4	+ 16.50	+ 61.81
OTC	39	62 — 35	38	• Computer Usage	— 2	— 5.00	— 2.99
AMSE	36 1/2	90 — 36	90 1/4	• Computing & Software	+ 8 1/4	+ 10.06	+ 147.26
OTC	12 1/2	24 — 11	24	• Datamation Services	+ 3	+ 14.27	+ 72.00
OTC	14 1/2	28 — 10	18	Datatab	+ 1/2	+ 3.22	+ 10.34
OTC	18 1/8	27 — 15	24	• Digitek	— 3/4	— 3.12	+ 32.00
AMSE	36 3/8	52 — 29	28 1/2	Electronic Computer Prog. Inst.	— 3/4	— 2.90	— 25.74
OTC	17 1/2	34 — 15	17 1/2	• Informatics	— 1/4	— 0.94	+ 51.41
OTC	21	28 — 4	15	Matrix Corp.	— 1/4	— 1.67	+ 28.57
OTC	5	28 — 4	18	• National Computer Analysts	+ 1	+ 5.83	+ 260.00
AMSE	31	61 — 28	61	Planning Research	— 5/8	— 1.01	+ 96.70
OTC	618 1/4	818 — 10	11 1/2	• Programming & Systems	+ 3/4	+ 6.97	+ 13.30
OTC	9	15 — 8	13	Software Systems	— 1/4	— 1.92	+ 13.89
OTC	629 1/2	644 — 8	30	Strategic Systems	— 1	— 3.29	+ 1.67
OTC	28	28 — 10	12 1/4	• Tab Computing Centers, Inc.	+ 1/2	+ 4.26	+ 46.29
OTC	12	12 — 8	9 3/4	United Data Centers	+ 2 1/2	+ 34.72	+ 8.33
OTC	63	182 — 57	145	• University Computing	+ 2	+ 1.39	+ 130.18
OTC	620	630 — 20	24 1/2	UTS Systems Corp.	+ 3/4	+ 3.16	+ 12.50
OTC	630	630 — 19	19	U.S. Time-Sharing	— 1	— 5.27	+ 40.00

EXCHANGE	BASE PRICE 1968-69 CLOSING 3-1-68	RANGE	PRICE	LEASING COMPANIES	WEEK NET CHANGE	WEEK % CHANGE	% CHANGE FROM BASE
OTC	18	18 — 5	13	Boothe Computer	— 1/2	— 3.13	+ 136.36
OTC	4 1/4	24 — 4	13 1/8	Computer Exchange	— 1 1/2	— 10.00	+ 217.60
AMSE	25 1/8	45 — 21	34 1/2	Computer Leasing	— 1 1/2	— 4.17	+ 37.32
OTC	615 3/4	615 — 10	13 3/4	Continental Computer	— 1/2	— 3.52	+ 20.25
OTC	12 1/4	21 — 11	21	Data Processing Fin.	— 1/2	— 4.66	+ 23.68
AMSE	106 5/8	92 — 44	69 3/4	• Data Proc. Financial & General	— 3/8	— 0.53	+ 48.07
OTC	28	34 — 13	18	Datronic Rental	+ 2	+ 13.33	+ 4.00
OTC	20	20 — 14	20	Dearborn Computer	+ 3 1/8	+ 18.52	+ 153.12
OTC	18 1/4	19 — 12	13 5/8	• DPA, Inc.	— 7/8	— 5.04	+ 2.83
AMSE	28 3/4	29 — 25	25 1/2	Greyhound Computer	— 3/4	— 2.86	+ 4.33
AMSE	36 1/8	66 — 36	43 1/2	Leasing Equipment Limited	+ 3 5/8	+ 7.81	+ 54.68
OTC	—	130 — 41	100	• Levin	+ 13 7/8	+ 16.26	+ 166.26
OTC	—	19 — 9	9	Levin Computer Leasing	+ 1 1/2	+ 20.00	+ 80.00
AMSE	36 3/4	66 — 27	66 1/2	Liberty Financial Computer Corp.	+ 1 7/8	+ 2.90	+ 76.75
OTC	10 1/2	22 — 9	21	Lloyd Elec. Inc.	+ 1/2	+ 2.43	+ 20.12
OTC	10 3/8	16 — 10	14 5/8	• Management Assistance	+ 7/8	+ 5.36	+ 34.48
AMSE	41 5/8	89 — 39	52	National Equipment Rental	+ 2 3/4	+ 7.81	+ 9.40
OTC	618 1/4	614 — 8	10 3/4	NCC Leasing	+ 1/4	+ 2.38	+ 18.81
AMSE	38	64 — 30	42 3/4	• Randcomm Computer Corp.	+ 3 1/4	+ 8.23	+ 12.50
OTC	68 1/2	68 — 20	27 1/2	Southern Capital Corp.	+ 3 1/2	+ 14.58	+ 340.00
OTC	—	— — —	—	Syscon Leasing	—	—	+ 117.64

a-Since 10/15/68 *Companies included in Computerworld's stock trading index for each sector.



Leasing Up 5.08%, Software Second

The stock market acted apathetically and undecidedly during President Nixon's first week in office.

The *Computerworld* composite stock index rose 3 points (2.19%) to 140.2, outrunning the Dow Jones industrial average's 3-point (.32%) increase for the week ended Jan. 24.

The Leasing Companies sector led the individual *Computerworld* indexes with a gain of 6 points (5.08%) to 124. Software & EDP Services followed with a rise of 7 points (3.61%) to 201.

Computer Systems pulled through a 2-point (1.54%) increase to 132. Peripherals & Subsystems lost slightly by 1 point (.79%) ending at 127, while Supplies & Accessories remained unchanged at 117.

For the same week Standard & Poor's industrial index nudged up .28%, the American Stock Exchange Price Index was up 1.9%, and the New York Stock Exchange index was up .73%.

Investors were apparently waiting to see whether the Paris peace talks would indicate some progress with the Nixon team in charge, and what effect the near-record interest rates and the Federal Reserve Board's tight rein on the money supply would have.

Gainers in the *CW* Trading Summary surpassed losers 58 to 43.

Computer Systems

IBM, pounded during the week by the filing of the long expected antitrust suit by the Justice Department on the last day of the Johnson administration, opened 12-1/2 points lower (295) on Monday morning, but recouped to end the day at an even 300.

This 300 support level, under constant heavy attack over the last several weeks, appears to be well entrenched.

The big gainers of the previous week, Burroughs and Honeywell, proved only average in performance for the week.

The largest percentage gains were scored by Electronic Associates, up 2 (15.25%) to 23-5/8; Raytheon, up 3-3/4 (8.37%) to 48-1/2; Control Data, up 8-5/8 (6.25%) to 146-1/4; and Digital Equipment Corp., up 10 (6.25%) to 170.

Scientific Control Corp. had the only major loss, 3-1/2 (8.64%) to 37.

Peripherals

Losses, although minor among the Peripherals & Subsystems, were not comparatively matched by gainers. Cognitronics lost 3-1/2 (9.10%) to 35; Computer Equipment was down 1-3/8 (8.60%) to 14-5/8; and Electronic Memories went down 5 (8.09%) to 57.

Potter Instrument was at the top with a gain of 1-1/2 (8.16%) to 33-1/8; followed by Bolt, Beranek with 1-1/4 (7.25%) to 18-1/2.

Software & EDP Services

Five stocks pushed the Software & EDP Service sector up 7 points to second place in overall performance for the week.

Computer Network, in addition to registering the largest overall gain, led the sector with a 15-point jump (37.50%) to 55; United Data Centers, up 2-1/4 (23.68%) to 11-3/4; Computer Sciences, up 8-1/4 (14.60%) to 64-3/4; Computer Environments, up 1-1/2 (13.04%) to 13; and Computing & Software, up 8-1/4 (10.06%) to 90-1/4, a new high.

Planning Research and Frederic Harris Inc.

LOS ANGELES – An agreement to acquire Frederic R. Harris, Inc., New York, an engineering design organization, was announced by Planning Research Corp.

Subject to approval by the board of directors and shareholders of Harris, Inc., the agreement calls for an initial payment to Harris of 350,000 shares of Planning Research common stock and up to 350,000 additional shares to be paid at the end of four years, the exact number to be determined by Harris' earnings during that period.

Computer Techniques and Gennaro Boston

NEW YORK – An agreement in principle has been reached for Advanced Computer Techniques Corp., a computer services company, and Gennaro Boston Associates S.P.A., Milan, Italy, a consulting firm, to form a new company in Italy for computer education. The agreement calls for 66% ownership by ACT and 34% by Gennaro Boston.

Concord College and H&G Technical Services

HANOVER, N.H. – Concord College, a computer education division of Computer Environments Corp., has acquired certain assets of H&G Technical Services and their subsidiary, Electronic Computer Programming Institute of Vermont and New Hampshire.

Gordon & Breach and Howard Institute

NEW YORK – Gordon & Breach, Science Publishers, Inc., has reached an agreement in principle to acquire Howard Institute of Technology, a computer training school and its subsidiaries through a stock transfer. The institute is privately owned.

Computer Research and Nursing Centers

PITTSBURGH, Pa. – Computer Research, Inc., a National Industries affiliate, has signed agreements in principle to acquire four nursing centers in Wisconsin for an undisclosed amount of cash and/or Computer Research stock, and a definitive agreement for the purchase of Nursing Centers, Inc., Milwaukee, a group of extended care facilities.

INFORMATICS, Inc. 5430 Van Nuys Blvd., Sherman Oaks, Calif., a computer services company. Filed to register 600,000 shares of common stock. Proceeds, at $35 per share maximum, intended for addition to the company's general funds. The underwriter is Dean Witter & Co., Inc., 632 S. Spring St., Los Angeles 90014.

TIME & SPACE COMPUTER CORP., 150 W. 53rd St., New York, a computer leasing company. Filed to register 100,000 shares of common stock. Proceeds, at $5 per share, intended for purchase of equipment and working capital. No underwriter is involved.

APPLIED LOGIC Corp., 1 Palmer Sq., Princeton, N.J., a computer time sharing services company. Filed to register 218,900 shares of common stock. Proceeds, at $30 maximum, intended for additional financing, research and development, and sales promotion costs. The underwriter is F.S. Moseley & Co., 50 Congress St., Boston.

VIATRON COMPUTER SYSTEMS Corp., 105 Terrace Hall Ave., Burlington, Mass., manufacturer of data processing devices, filed to register 840,000 common shares. Proceeds, at $15 per share maximum, intended for the purchase of components, product development, marketing and advertising expenses, and general corporate purposes. The underwriter is Shields & Co., Inc, 44 Wall St., New York 10006.

TAB PRODUCTS Co., 835 Battery St., San Francisco, distributors of computer auxiliary equipment, filed to register 210,000 shares of common stock. Proceeds, at $22 per share maximum, intended for repayment of debt and for working capital. The underwriter is Roberts, Hirt & Co., Inc., First National Bank Bldg., San Diego, Calif. 92112.

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But each job took an awful lot of explaining because Charlie was pretty stupid—even for a giant! In fact, the King maintained a tower full of Scholars just to tell the giant what to do. It took them a fortnight to get Charlie started on a job he could do in a trice.

As a result, the giant spent most of his time sleeping. There was nothing else for him to do.

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PRD Gets a $10-Million Navy Contract For Nine Carrier-Based 'Vast' Systems

The Naval Air Systems Command has awarded PRD Electronics, Inc., a subsidiary of Harris-Intertype Corporation, a $10,231,000 letter contract for computer-controlled systems to test the electronic equipment on carrier-based aircraft. When the formal contract is issued, the amount is expected to increase by approximately $20.4 million.

The $10.2 million letter contract makes a total of $49.4 million awarded PRD Electronics in the past 18 months for its Versatile Avionic Shop Test (Vast) systems.

The new contract calls for production of nine Vast systems for support of the Navy's A-7E Corsair II attack planes. It includes an option for the procurement of seven additional Vast test stations at a price to be negotiated.

The systems will be installed aboard attack carriers and at shore stations to support both current and future Navy and Marine avionic systems. The Navy has stated that Vast can provide a billion-dollar savings in avionic support costs over a 20-year period.

The automatic checkout systems are expected to release avionic shop space on carriers for other users and reduce the number of technicians required, while improving the quality of testing.

Litton Subcontracts NCR

Litton Industries has awarded NCR's Military Division a $9 million contract for the design and production of electronic keyboards and high-speed, non-impact thermal printers to be used for the Army Tacfire program.

Tacfire provides an automatic data processing system to improve the effectiveness of field artillery fire support through increased accuracy.

Tisco to Upgrade Naas

Naas has awarded a $4.3 million per year contract to Tisco, College Park, Md. for operating and upgrading the services of the Naas Scientific and Technical Information Facility in Maryland.

The facility has been operating under batch process EDP but will switch to real time and be upgraded to a third generation system level using the latest hardware and software techniques.

CONTRACTS

AF Picks Burroughs

The Air Force has awarded a $283,000 contract to Burroughs' Defense, Space and Special Systems Group, Paoli, for development of a low cost memory system to be used with aerospace computers.

Basically an automatic information processing system, the memory will be developed for the Air Force Avionics Laboratory, Wright Patterson AFB, Dayton. It will utilize Burroughs developed magnetic thin film.

ISC Orders 5 PDP-10/50's

Interactive Sciences Corp., Braintree, Mass., a time-sharing and management sciences firm, has placed an initial order with Digital Equipment Corp., Maynard, Mass. for five PDP-10/50 computer/communications systems. The first system will be installed during the spring, with the balance of the systems scheduled for delivery over an 18-month period.

US Buys 10 SCC4700's

Universal Systems, Inc., Washington, D.C. has contracted to purchase ten SCC 4700 computers and five data communications terminals from Scientific Control Corp., Dallas. Software will be included. The systems will be used for communications processing.

Oil Co. Signs for 360/50

Scientific Resources Corp., Philadelphia, has signed a four-year computer resources financing agreement with Atlantic Richfield Co. Under the terms of the equipment financing and services performance agreement, a subsidiary of Scientific Resources will install an IBM 360/50 in Dallas.

The system will be used for scientific, commercial, and seismic applications. The agreement also provides for the design of software packages.

Burroughs and PO Sign

The U.S. Post Office Dept. has awarded a $900,000 contract to Burroughs' Defense, Space and Special Systems Group, Paoli, Pa. for the development of an optomechanical mail directory system designed to speed delivery of incorrectly addressed mail to soldiers in Viet Nam and to effect savings in the Army Postal Directory Service.

The system consists of 17 teleprinters, 10 letter consoles, a parcel conveyor system and a B300 computer.

AF Awards Two to RCA

The Air Force has awarded two contracts to RCA to expand current equipment and add new instrumentation in the Aerospace Defense Command's Central Computer and Display Facility. New integrated circuit techniques will be employed throughout the new designs.

BB&N to Build Processors

The Defense Supply Service, Washington, D.C., has awarded a $1,077,727 cost-plus-fixed-fee contract to Bolt, Beranek and Newman, Inc., Cambridge, Mass. for the design and installation of interface message processors.

Earnings Reports

SHERWOOD LEASING CORP.
6 Months Ended Nov. 30

	1967	1968
Revenus	$740,000	$1,185,000
bEarnings	58,000	196,000
Shr Ernd	.31	.58

b—Unaudited. b—Includes investment tax credit. c—Based on average number of common shares outstanding.

ANALYSTS INTERNATIONAL
3 Months Ended Sept. 30

	1967	1968
Revenus	$257,218	$358,402
Earnings	(2,847)	10,600

BERGEN DRUG CO., INC.
3 Months Ended Nov. 30

	a1967	1968
Revenus	$9,758,338	$10,708,816
Earnings	202,315	303,223
Shr Ernd	.22	.30

a—Restated to include acquisition.

POWER INDUSTRIAL PRODUCTS CO.
Year Ended Aug. 31

	1967	1968
Revenus	$11,847,217	$10,104,080
Earnings	21,881	(830,853)
aShr Ernd	.49	

a—Adjusted for all potential dilution, per share earnings would be 34% in 1967.

HARRIS-INTERTYPE CORP.
3 Months Ended Dec. 31

	1967	1968
Revenus	$ 67,648,035	$ 78,824,709
Earnings	3,723,581	4,853,342
Shr Ernd	.68	.84

SPERRY RAND CORP.
3 Months Ended Dec. 31

	1967	1968
Revenus	$398,832,000	$410,646,000
Earnings	18,668,000	20,838,000
Shr Ernd	.96	.61

DATA CONTROL SYSTEMS
3 Months Ended Dec. 31

	1967	1968
Revenus	$ 1,538,397	$ 1,883,642
Earnings	20,877	24,574
Shr Ernd	.02	.03

SCM CORP.
3 Months Ended Dec. 31

	1967	1968
Revenus	$ 85,180,000	$205,301,000
Earnings	4,834,000	8,806,000
Shr Ernd	.58	.68

Assuming stock conversion and option conversion.

BRANDON APPLIED SYSTEMS
3 Months Ended Nov. 30

	1967	1968
Revenus	$404,336	$846,687
Earnings	(20,321)	45,597
Shr Ernd		.05

BURROUGHS CORP.
Year Ended Dec. 31

	1967	1966
Revenus	$653,886,000	$635,560,000
Earnings	34,830,000	43,301,000
Shr Ernd	4.26	5.27

URS SYSTEMS CORP.
Year Ended Oct. 31

	1967	1968
Revenus	$ 7,700,000	$ 12,300,000
Earnings	297,823	729,813
Shr Ernd	.27	.58

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AT&T TWX Sale to WU Affects Dataphone Users

(Continued from Page 1)

Western Union told *Computerworld* that it intends to market teletypewriters for Dataphone customers. The company does not intend, at present, to make available the Dataphone-dataset to connect these terminals to the AT&T telephone lines, however.

Neither company appears to plan on supplying datasets for users of this particular type of Dataphone equipment, therefore forcing the user to find his own source of supply. This may introduce the problems which always arise whenever a mixed-manufacturer system is used. No one will be willing to fully support the equipment, and each will generally blame the other manufacturer for troubles.

Standards for datasets will have to be generally available, and those manufacturers who produce interfaces between Teletypes and telephone lines will probably benefit enormously from the situation. The problems, however, still rest with the user.

If he intends to expand, he will have to allow for these complications when planning for the future.

Who Will Pay for the Units?

What about the problems created for multiline users, who have multiple service over the same teletypewriter? (*Computerworld*, for example, has both TWX and Dataphone lines on its Teletype.) Top officials of AT&T, Western Union, and Teletype Corp. were unable to answer our inquiries as to who we will be paying for what. Under the agreement, WU is to acquire "TWX equipment on customers' premises. . . ." However, the sale "wouldn't include the Teletype machines used by AT&T's 'Dataphone' customers."

This type of problem and many others remain to be spelled out for users.

Honeywell Opens Service Bureaus

(Continued from Page 1)

a broadened range of computer and computer-related services.

Charles L. Davis, vice president and Computer and Communications Group executive, said the move "will put Honeywell squarely into one of the fastest growing segments of the computer industry." He cited industrial surveys indicating that the information services field would nearly triple in volume to about $2.7 billion by 1972 from its 1967 level of $950 million.

47% Vote Tallied On ACM Ballot

NEW YORK — 47% of the ACM membership voted on the recent "question of importance" on the proposal to create an ACM news publication. The vote went heavily against the publication, 5586 to 2109.

'Maybe Reform Is Possible'

Carol Sampson, who forced the ballot by submitting a petition and who recently appealed for a heavy vote (CW, Jan. 22), said that she was very happy with the size of the vote.

"Full elections only obtain some 55%," she said, "and we got 47% voting. Maybe reform is possible after all. There seems to be an interested and thoughtful membership out there."

Payroll System Hit By Error Problems

(Continued from Page 1)

ject to "an excessive rate of error." The group attributed the poor conditions at that time to inadequate design of the basic system, repeated modification to computer programs, inadequate computer size, inadequate system documentation, and the use of short-range rather than long-range solutions.

In its report issued last week, the accounting office reported that an examination of 300 employees' 1965 pay records selected at random disclosed 155 errors in 69 records, or 23% of those examined. Tests of pay records for subsequent periods showed that similar types of errors had continued to occur as recently as July, 1968, the agency added. GAO estimated that in HEW'S 1965 payroll alone, errors had totaled about $900,000 in computations of gross earnings, about $3.1 million in employees' leave balances; and about $7.1 million in the gross earnings and tax deductions shown on employees' annual withholding statements which could result in overpayments and underpayments of federal and state income taxes.

GAO recommended that the secretary of HEW "assign a high priority to redesign of the payroll system and keep these efforts under close surveillance until the redesign is successfully completed." It also suggested that HEW officials take full advantage of information available from agencies that already have developed effective automated central payroll systems. HEW's internal audit organization should be consulted in the redesign of the system to help ensure that adequate controls are established and adequate audit trails are provided in the system to avoid costly changes after the revised system has been installed, GAO concluded.

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